



**Department of
Transportation**

I-81 VIADUCT PROJECT - PHASE 1, CONTRACT 1

PIN 3501.90, Contract D900054

DB CONTRACT DOCUMENTS REQUEST FOR PROPOSALS

PART 7

ENGINEERING DATA (PART 5 OF 5)

Draft May 17, 2022

ENGINEERING DATA

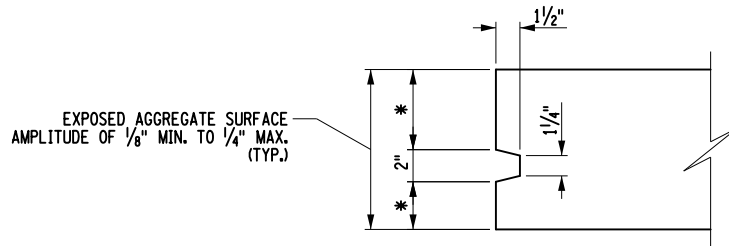
TABLE OF CONTENTS

STRUCTURAL DETAILS

RESTORATION PLANS

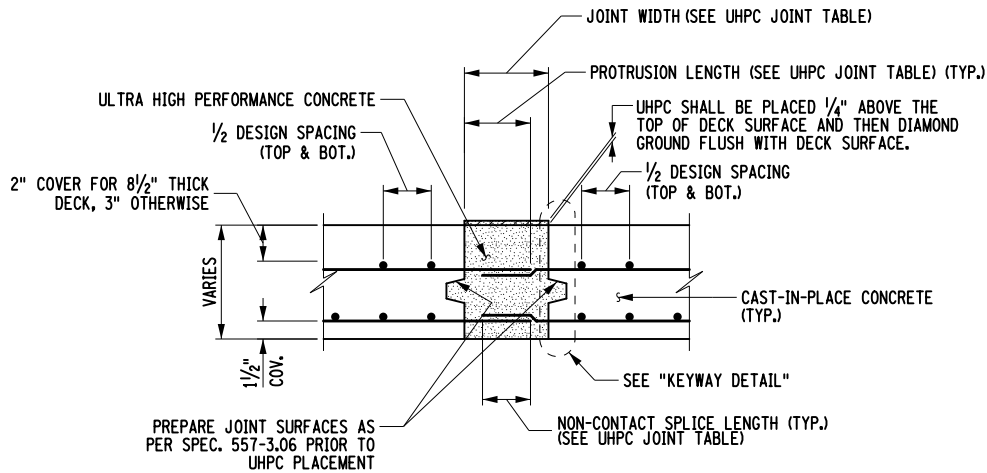
HAZARDOUS WASTE CONTAMINATED MATERIALS ADDITIONAL INFORMATION

Structural Details



* - PROVIDE DIMENSION TO AVOID INTERFERENCE WITH THE REINFORCEMENT.

KEYWAY DETAIL



LONGITUDINAL UHPC JOINT

UHPC JOINT TABLE					
BAR SIZE	JOINT WIDTH	PROTRUSION LENGTH	SPLICE LENGTH	CLEAR SPACING	
				MINIMUM	MAXIMUM
#4	6"	5"	4"	1"	4"
#5	7"	6"	5"	1 1/4"	5"
#6	9"	7 1/2"	6"	1 1/2"	6"

DESIGNER NOTE:

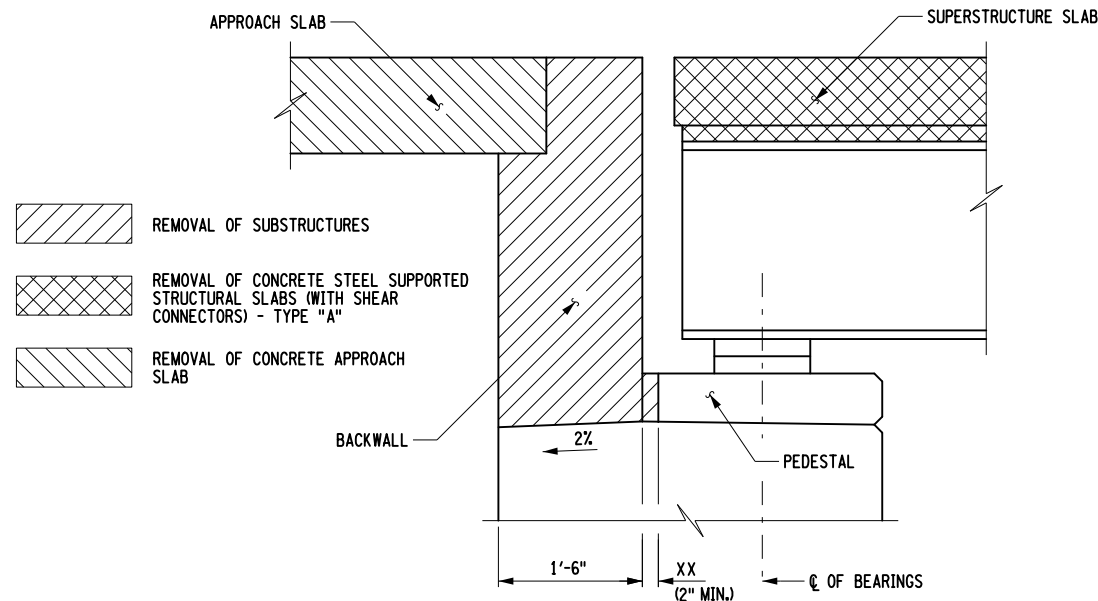
UHPC JOINT TABLE IS APPLICABLE FOR ALL BAR TYPES WITH A YIELD STRENGTH NO GREATER THAN 75 KSI.

ALL DIMENSIONS ARE IN FT UNLESS OTHERWISE NOTED

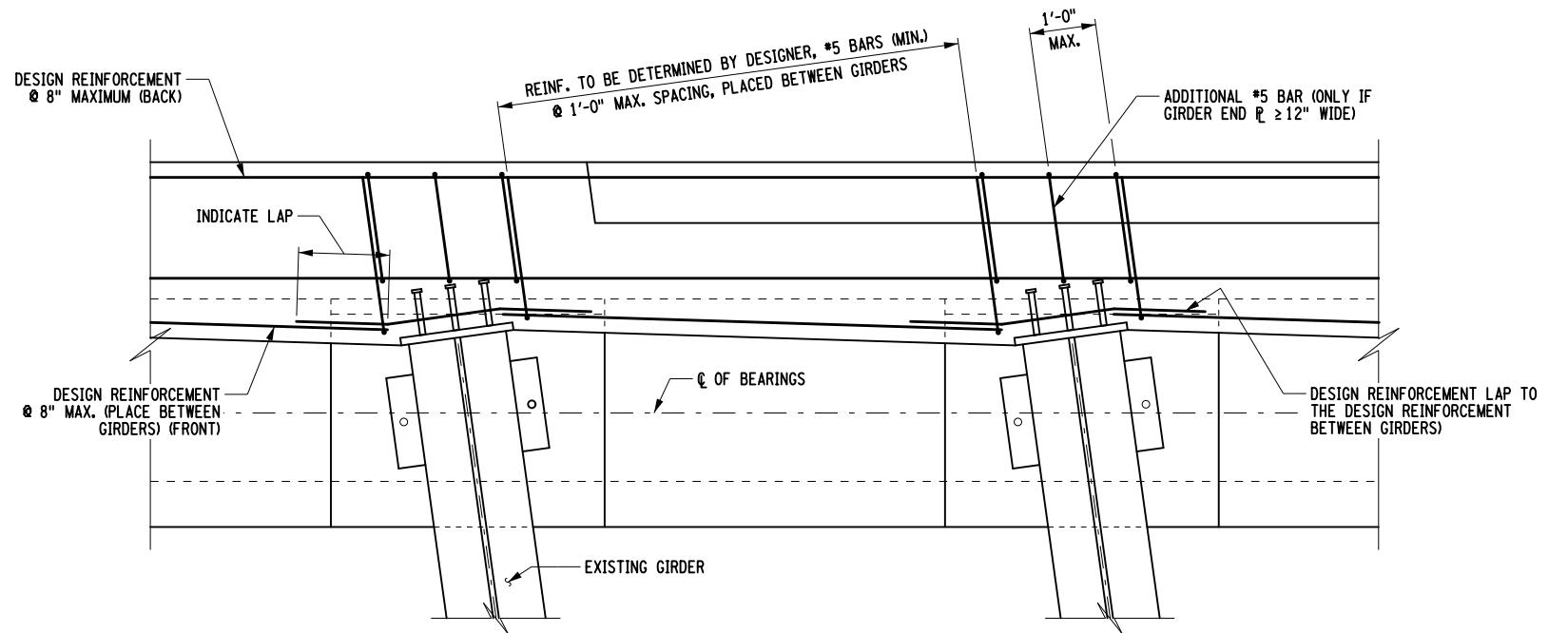


**Department of
Transportation**

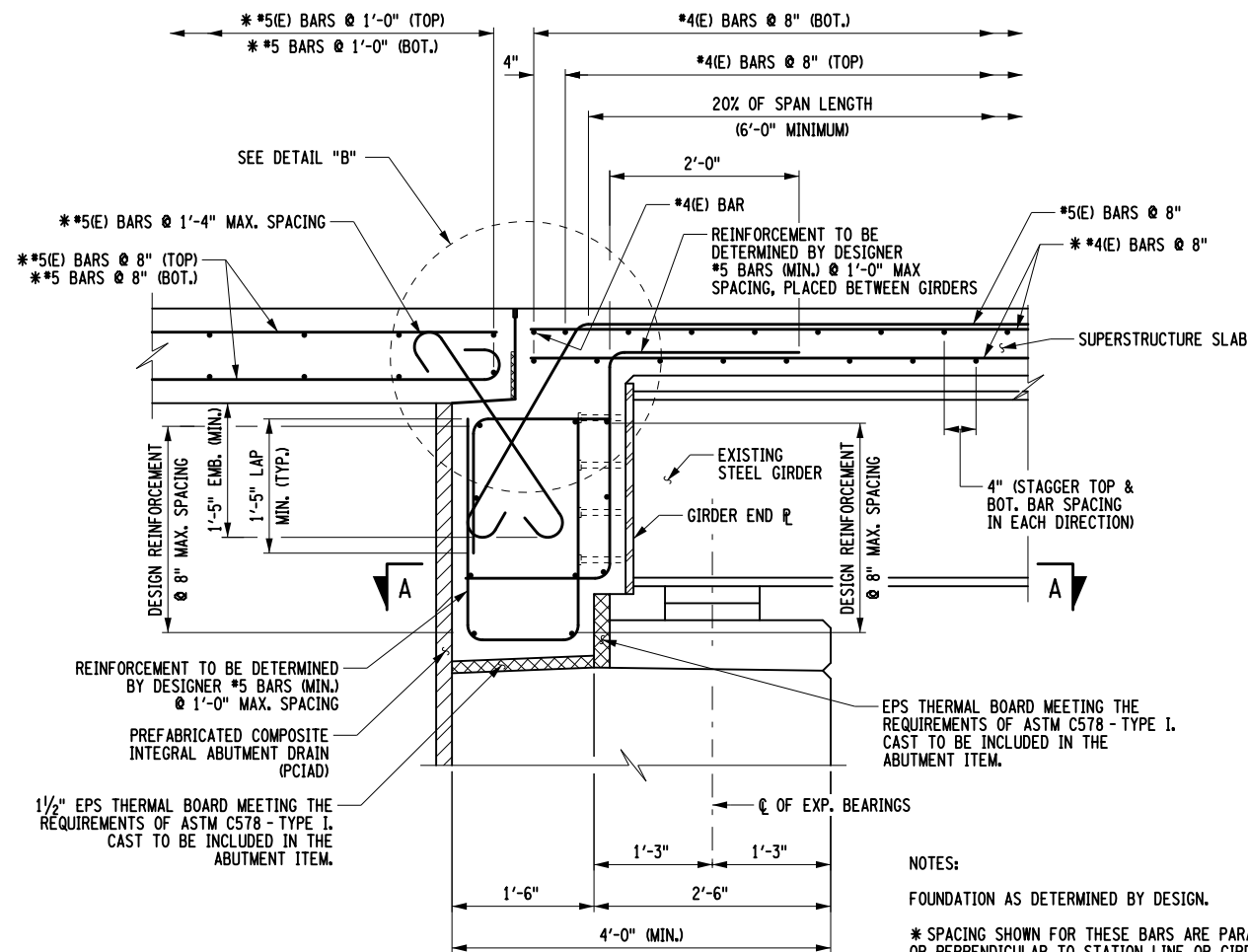
LONGITUDINAL UHPC JOINT DETAILS



REMOVAL SECTION



SECTION A-A



PROPOSED SECTION

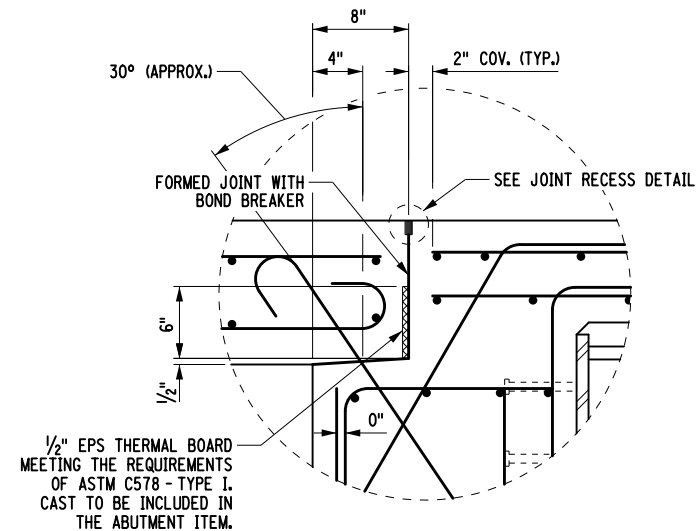
NOTES:

FOUNDATION AS DETERMINED BY DESIGN.

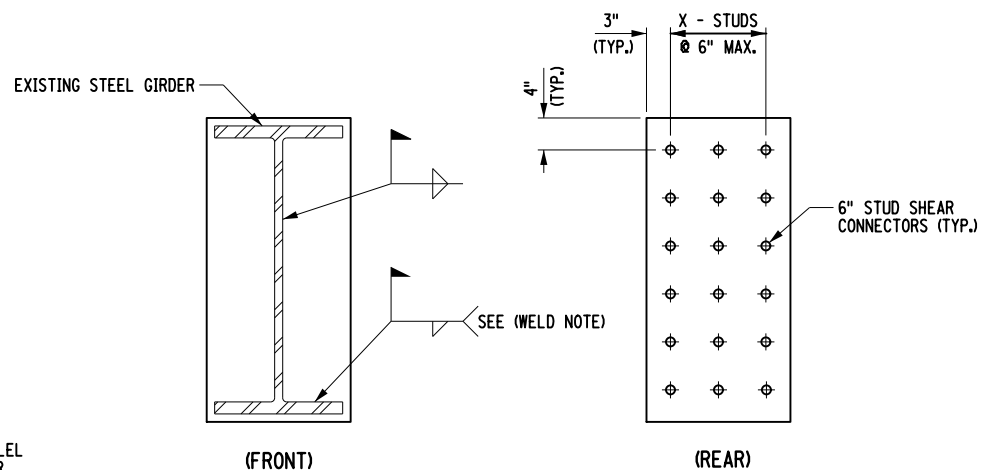
* SPACING SHOWN FOR THESE BARS ARE PARALLEL OR PERPENDICULAR TO STATION LINE OR GIRDER.

TYPICAL 6" COMPOSITE STUD SHEAR CONNECTORS ON TOP OF GIRDER NOT SHOWN FOR CLARITY.

END DIAPHRAGM NOT SHOWN FOR CLARITY.



DETAIL "B"



GIRDER END PLATE DETAIL

WELD NOTE:

STOP THE WELDS 1/2" FROM THE OUTSIDE OF THE FLANGE PLATES (TYP. ALL FOUR LOCATIONS).

DESIGNER NOTES:

THE SUPPORT RODS AND BASE PLATE ARE TO BE DESIGNED TO SUPPORT THE DEAD LOAD OF THE GIRDERS, DIAPHRAGMS, AND ANY UTILITIES.

TOP REINFORCEMENT IN SLAB NEEDS TO BE CHECKED FOR NEGATIVE MOMENT DEVELOPED FROM BACKWALL AND APPROACH SLAB.

ISOTROPIC DECK REINFORCEMENT FOR SKEWS 30° AND UNDER SHOWN. FOR TRADITIONAL DECK REINFORCEMENT, SEE BD-SS10 & 11.

EPOXY-COATED (E) BARS SHOWN. OTHER CORROSION PROTECTION OPTIONS ARE AVAILABLE. REFER TO SECTION 15.12 OF THE BRIDGE MANUAL.

EVERY BAY SHALL HAVE AN INTERMEDIATE TYPE DIAPHRAGM INSTALLED AT THE CENTERLINE OF BEARINGS OF EACH ABUTMENT. FOR TYPICAL DIAPHRAGM DETAILS, SEE THE BD-SG DRAWINGS.

FOR STEEL INTEGRAL ABUTMENT KEYWAY DETAILS, SEE BD-ID7.

SEE EARTHWORK DETAILS ON BD-ID7 FOR FURTHER DETAILS.

FOR JOINT RECESS DETAIL, SEE BD-ID10.

FOR TYPE "D" WATERSTOP DETAILS, SEE BD-MS3.

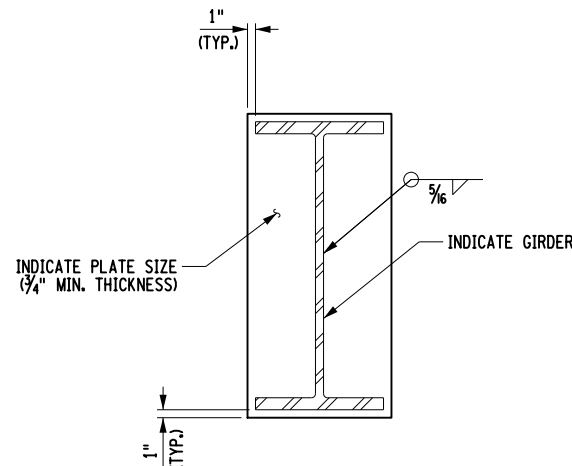
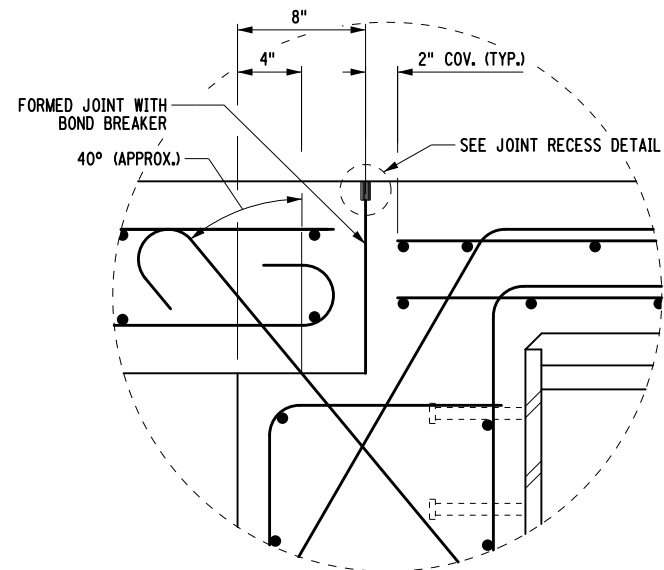
SEMI - INTEGRAL ABUTMENT CONSTRUCTION PROCEDURE

1. PLACE ABUTMENT SUSPENDED BACKWALL AND DECK CONCRETE.
2. RESET BEARINGS.
3. BACKFILL ABUTMENT BACKWALLS. NO BACKFILLING OF THE ABUTMENT IS ALLOWED UNTIL BACKWALLS HAVE CURED FOR 7 DAYS. BACKFILLING SHALL BE CONDUCTED SUCH THAT THE MAXIMUM DIFFERENTIAL IN FILL HEIGHT BETWEEN THE TWO STEMS (AS MEASURED FROM THE BOTTOM OF THE STEM) DOES NOT EXCEED 2 ft. IN ADDITION, THE FILL HEIGHT BEHIND ANY SINGLE ABUTMENT STEM SHALL NOT VARY MORE THAN 2 ft.
4. PLACE CONCRETE FOR APPROACH SLABS.

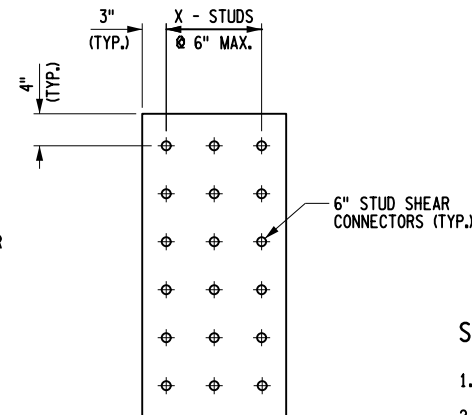


Department of Transportation
Office of Structures

SEMI-INTEGRAL ABUTMENT
RETROFIT DETAILS



STEEL GIRDER
AND PLATE DETAIL



STUD SHEAR
CONNECTOR LAYOUT

SEMI-INTEGRAL ABUTMENT CONSTRUCTION PROCEDURE

1. PLACE FOOTING, ABUTMENT STEM, AND PEDESTALS.
2. BACKFILL ABUTMENT STEMS TO 6" BELOW THE BRIDGE SEAT ELEVATION. NO BACKFILL OF THE ABUTMENT STEMS ALLOWED UNTIL THE ABUTMENTS HAVE CURED FOR 7 DAYS.
3. PLACE STONE FILL OR SLOPE PROTECTION.
4. ERECT GIRDERS AND INSTALL ALL DIAPHRAGMS.
5. PLACE ABUTMENT BACKWALL AND DECK CONCRETE.
6. BACKFILL ABUTMENT BACKWALLS. NO BACKFILLING OF THE ABUTMENT IS ALLOWED UNTIL BACKWALLS HAVE CURED FOR 7 DAYS. BACKFILLING SHALL BE CONDUCTED SUCH THAT THE MAXIMUM DIFFERENTIAL IN FILL HEIGHT BETWEEN THE TWO ABUTMENTS (AS MEASURED FROM THE BOTTOM OF THE BACKWALL) DOES NOT EXCEED 2 ft. IN ADDITION, THE FILL HEIGHT BEHIND ANY SINGLE ABUTMENT BACKWALL SHALL NOT VARY MORE THAN 2 ft.
7. PLACE CONCRETE FOR APPROACH SLABS.

DESIGNER NOTES:

ISOTROPIC DECK REINFORCEMENT FOR SKEWS 30° AND UNDER SHOWN. FOR TRADITIONAL DECK REINFORCEMENT, SEE BD-SS10 & 11.

EPOXY-COATED (E) BARS SHOWN. REFER TO BRIDGE MANUAL, SECTION 15.12 FOR THE REQUIREMENTS OF CORROSION PROTECTED REINFORCEMENT IN SUBSTRUCTURES.

EVERY BAY SHALL HAVE AN INTERMEDIATE TYPE DIAPHRAGM INSTALLED AT THE CENTERLINE OF BEARINGS OF EACH ABUTMENT. FOR TYPICAL DIAPHRAGM DETAILS, SEE THE BD-SG DRAWINGS.

WEEPHOLES SHALL BE PROVIDED IN THE ABUTMENT STEM AT A MAXIMUM SPACING OF 25'-0".

SEE EARTHWORK DETAILS ON BD-ID7 FOR FURTHER DETAILS.

FOR JOINT RECESS DETAIL, SEE BD-ID6.

NOTES:

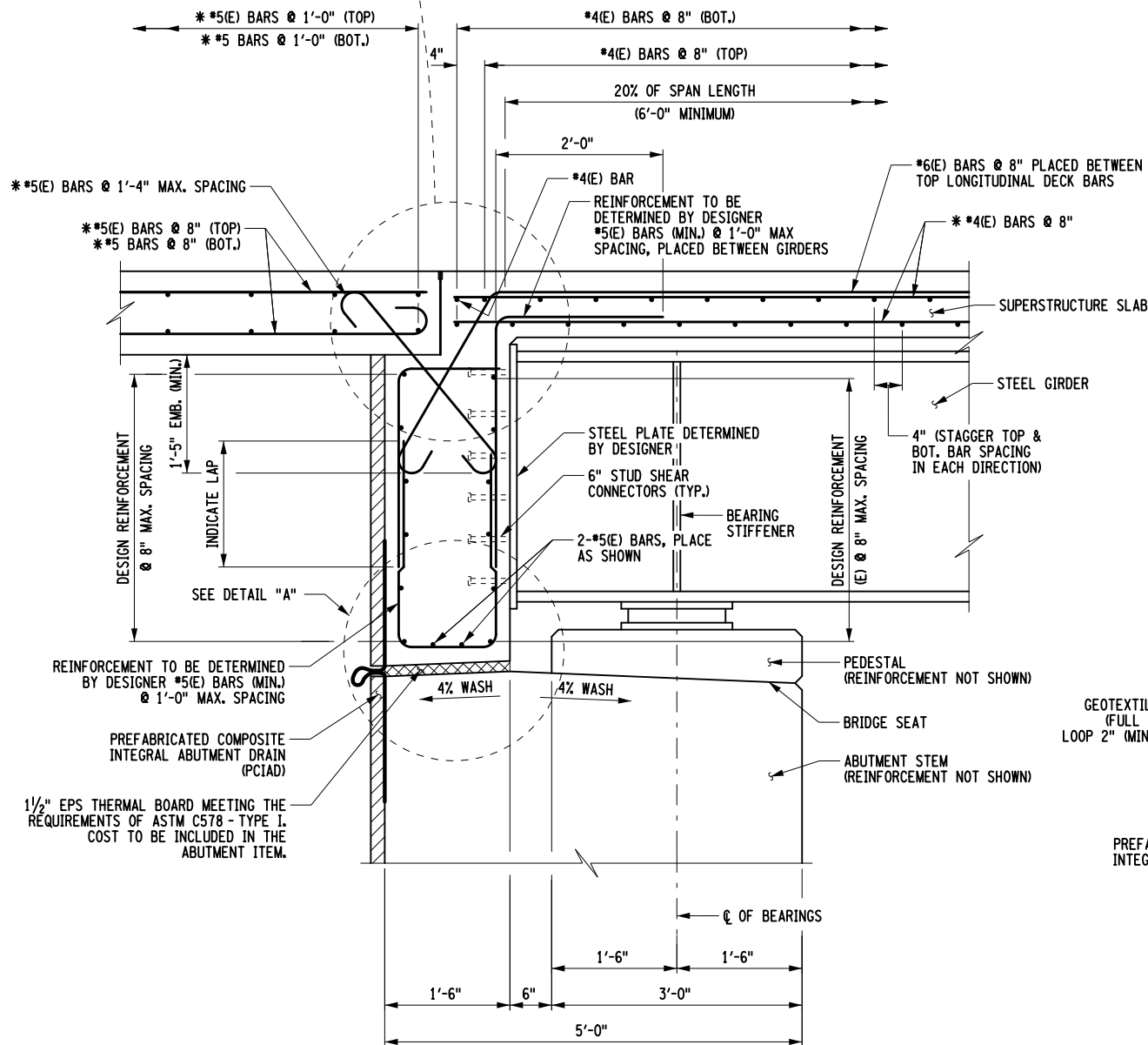
END DIAPHRAGM NOT SHOWN FOR CLARITY.

* SPACING SHOWN FOR THESE BARS ARE PARALLEL OR PERPENDICULAR TO STATION LINE OR GIRDER.

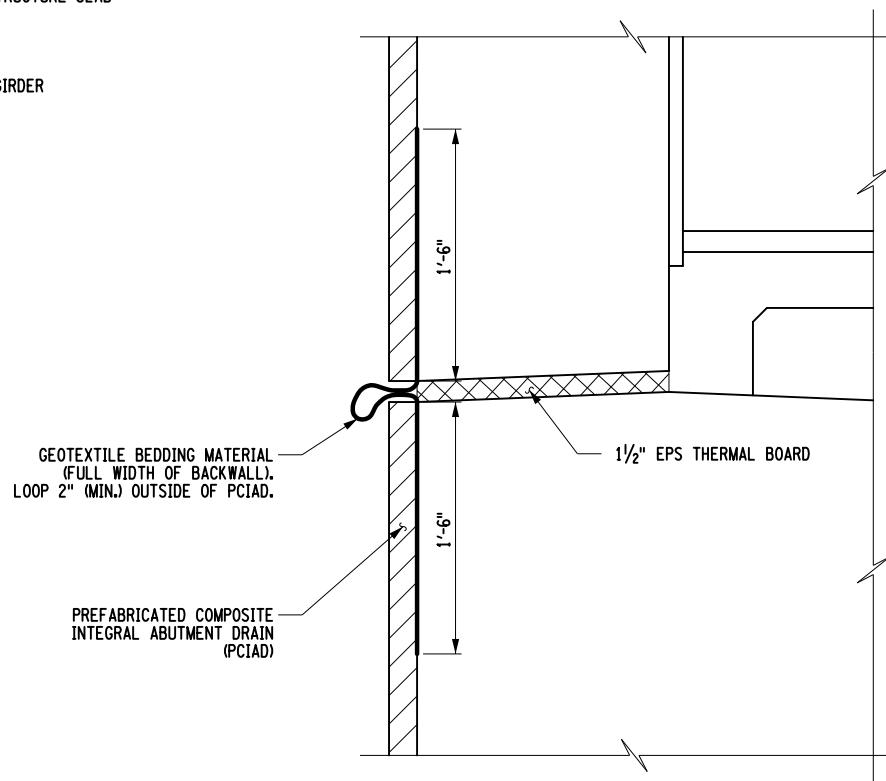
TYPICAL 6" COMPOSITE STUD SHEAR CONNECTORS ON TOP OF GIRDER NOT SHOWN FOR CLARITY.

REINFORCEMENT IN BACKWALL SHALL HAVE 2" COVER.


(E) DENOTES EPOXY-COATED BARS.

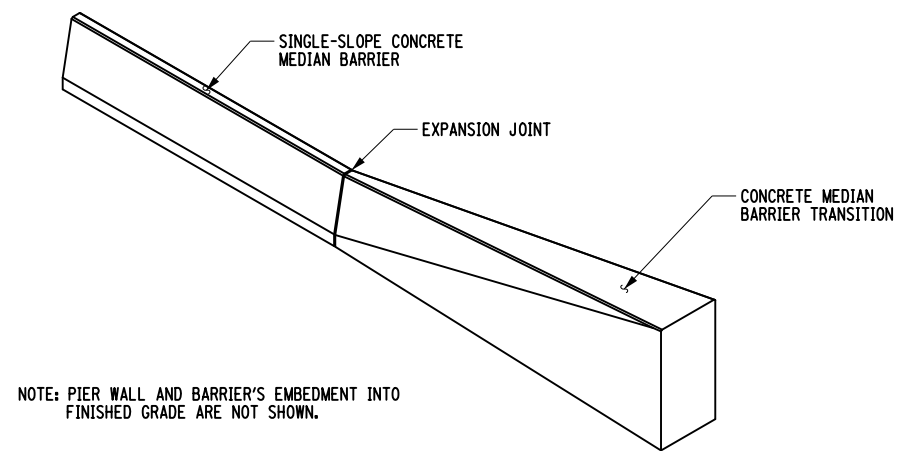
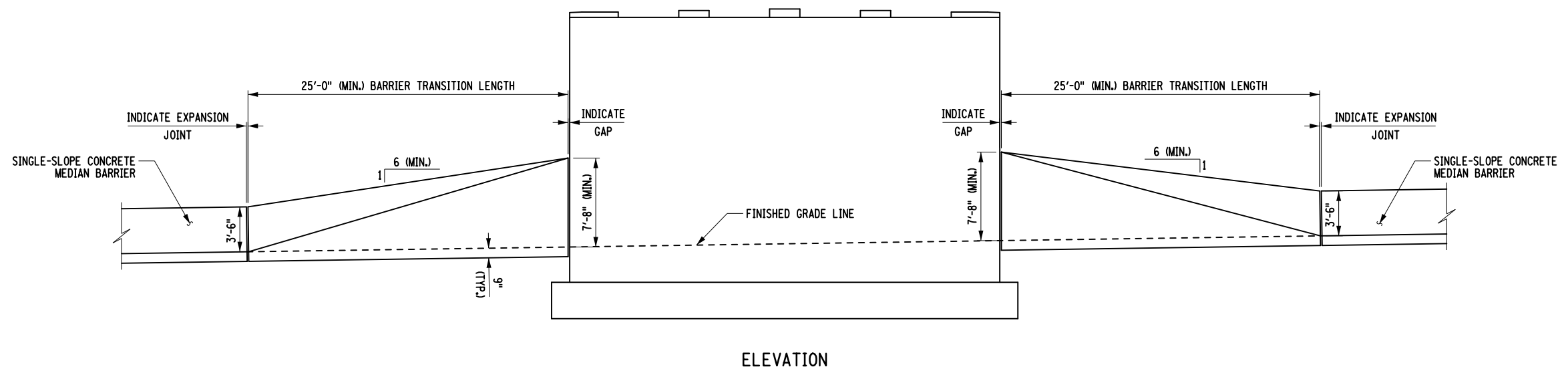
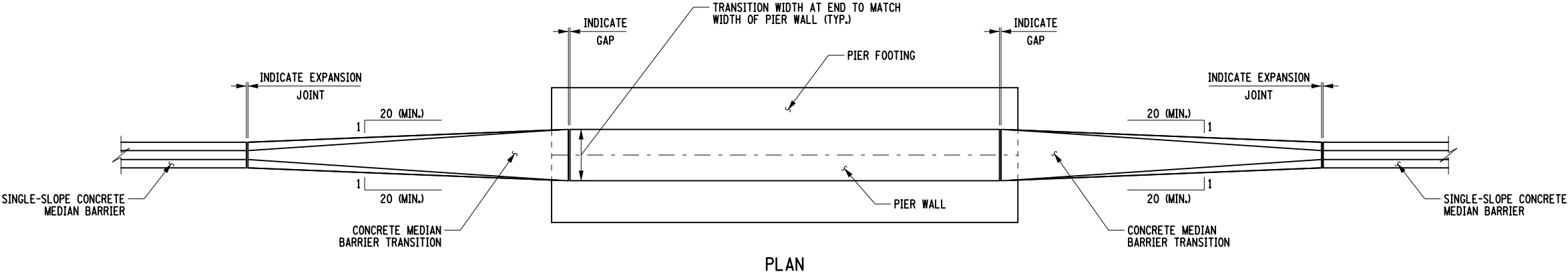


TYPICAL ABUTMENT SECTION
(SECTION TAKEN PERPENDICULAR TO ABUTMENT)




DETAIL "A"

REVISED	 NEW YORK STATE OF OPPORTUNITY.	Department of Transportation Office of Structures	
	ALTERNATE SEMI-INTEGRAL ABUTMENT DETAILS		
ERRATA			
	APPROVED: / / ORIGINAL SIGNED BY	ORIGINAL ISSUED UNDER EB	
	DEPUTY CHIEF ENGINEER (STRUCTURES)	CURRENT ISSUED UNDER EB EFFECTIVE WITH THE LETTING OF / /	

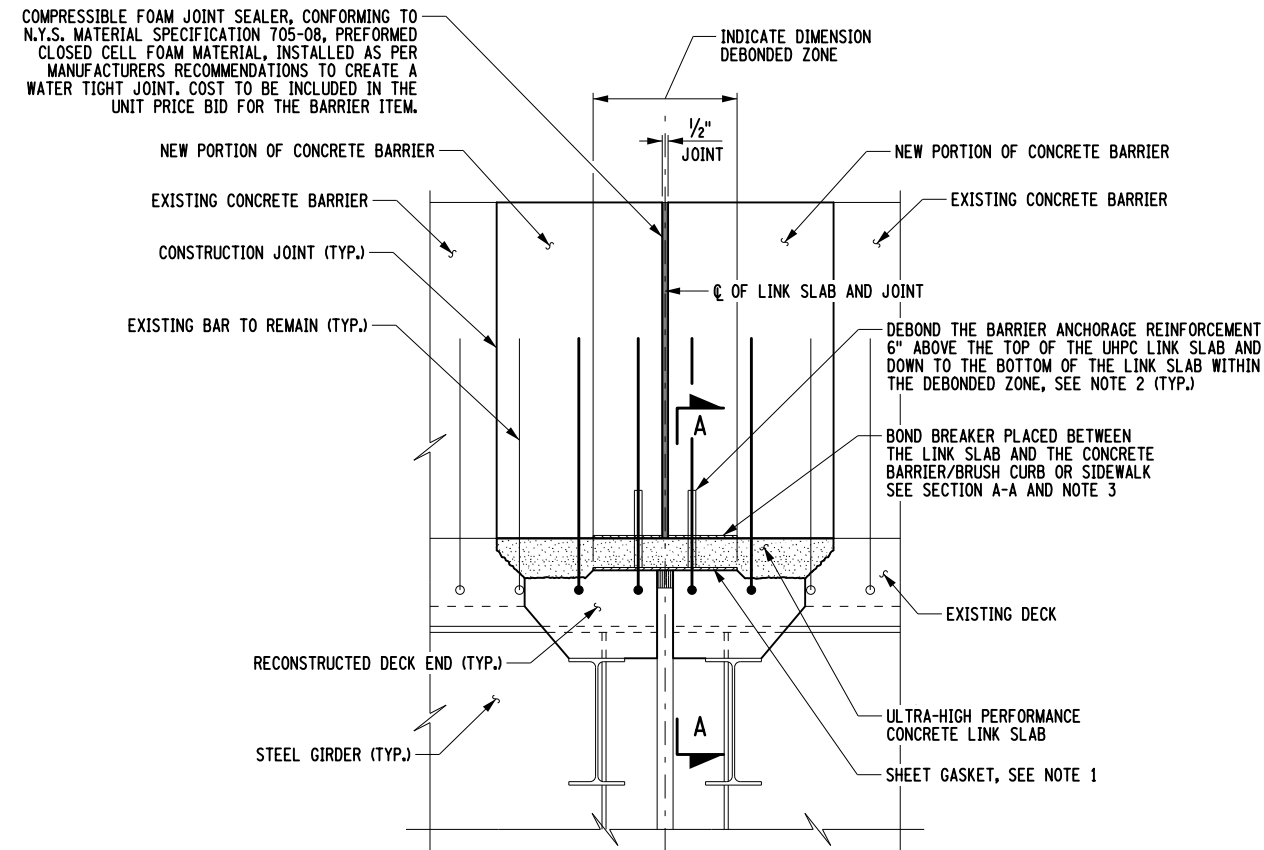


NOTE: PIER WALL AND BARRIER'S EMBEDMENT INTO FINISHED GRADE ARE NOT SHOWN.

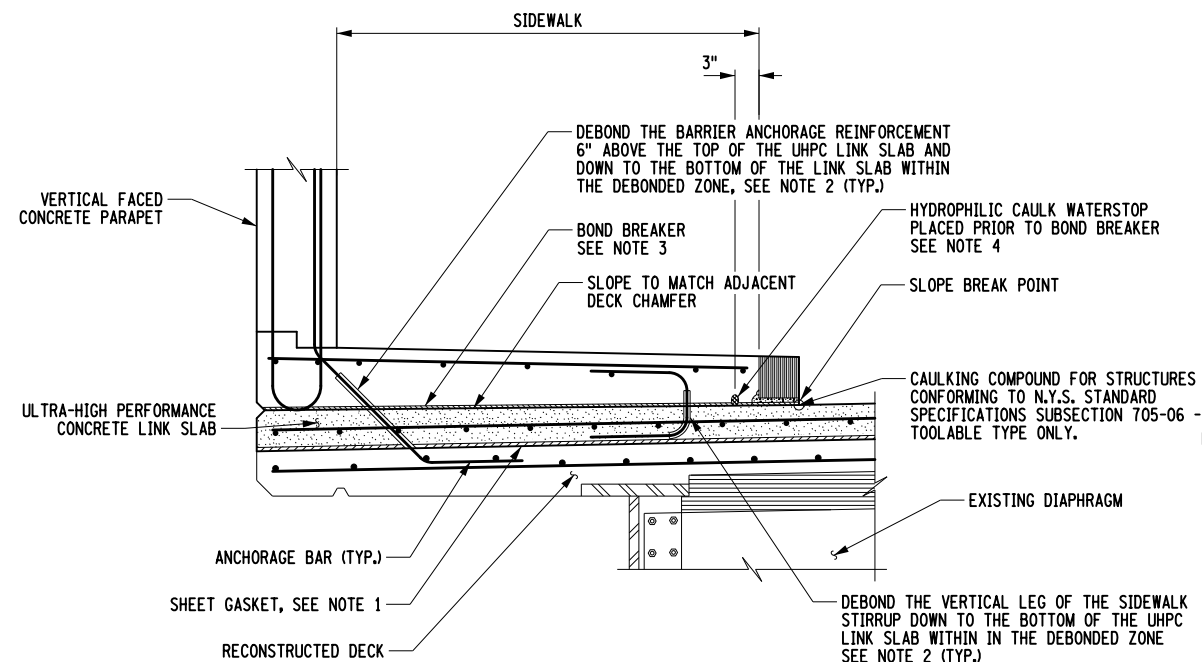
REVISED	 NEW YORK STATE OF OPPORTUNITY.	Department of Transportation Office of Structures
ERRATA	BARRIER TO PIER TRANSITION DETAILS	
APPROVED: / / ORIGINAL SIGNED BY:		ORIGINAL ISSUED UNDER EB
DEPUTY CHIEF ENGINEER (STRUCTURES)		CURRENT ISSUED UNDER EB EFFECTIVE WITH THE LETTING OF / /

SCHEMATIC UHPC LINK SLAB DETAIL
JOINT REPLACEMENT - WITHOUT GIRDER HAUNCH

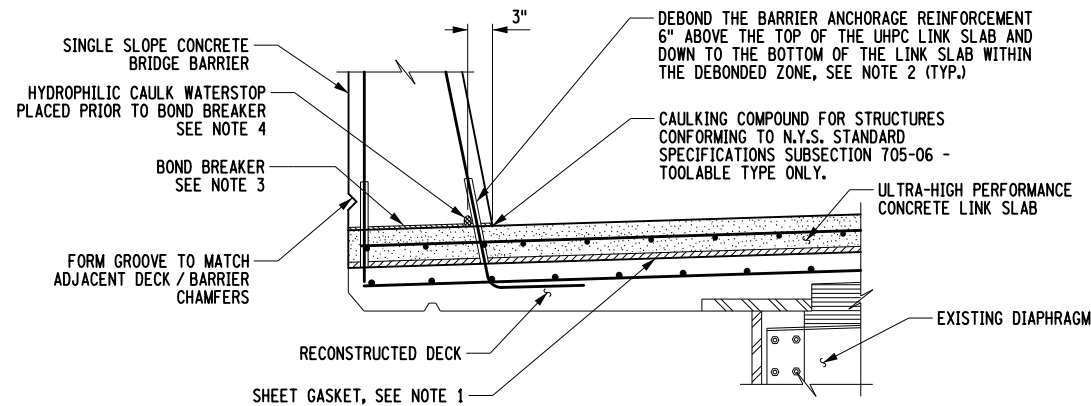
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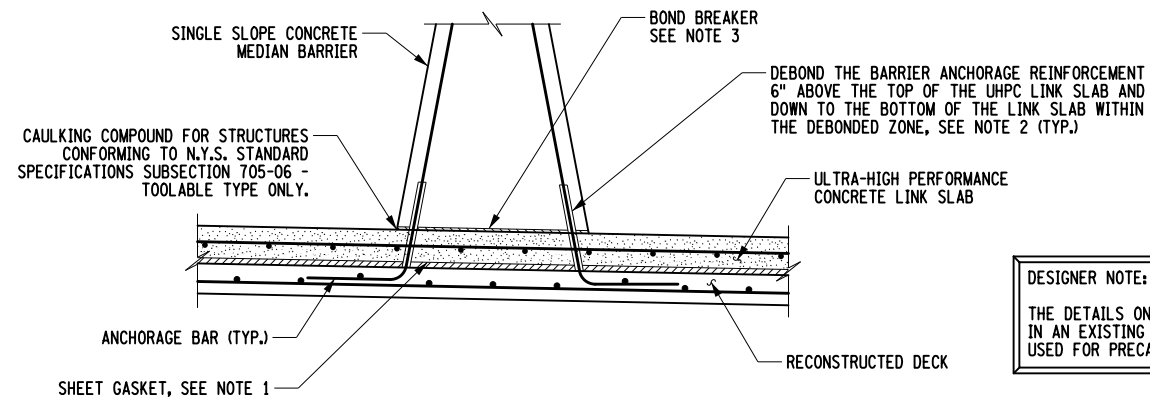
ELEVATION
RELIEF JOINT OVER UHPC LINK SLAB
(SINGLE SLOPE CONCRETE BARRIER SHOWN, SIDEWALK AND BRUSH CURB SIMILAR)



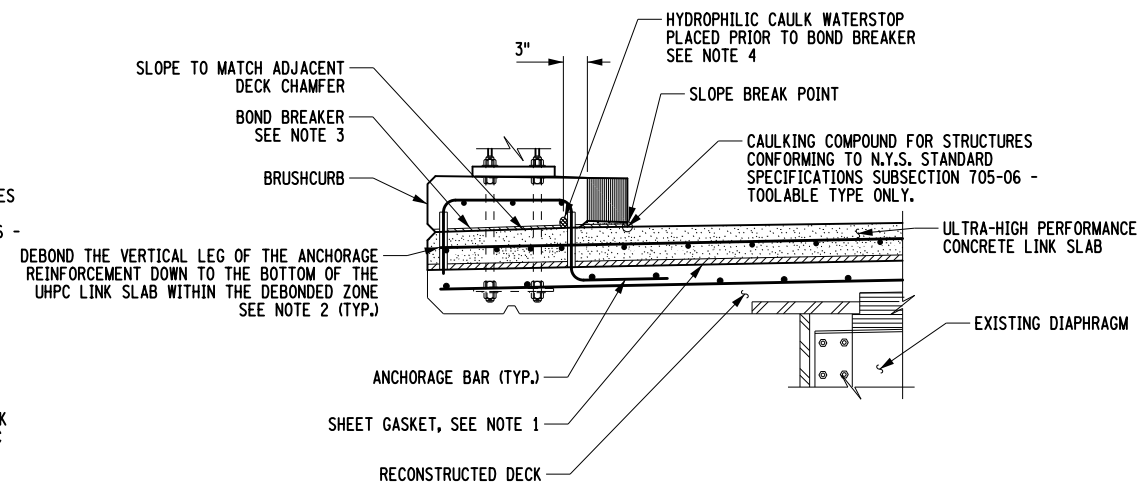
SECTION A-A
(VERTICAL FACED CONCRETE PARAPET WITH SIDEWALK)



SECTION A-A
(SINGLE SLOPE CONCRETE BRIDGE BARRIER)



SECTION A-A
(SINGLE SLOPE CONCRETE MEDIAN BARRIER)




SECTION A-A
(STEEL BRIDGE RAIL WITH BRUSH CURB)

DESIGNER NOTE:

THE DETAILS ON THIS DRAWING DEPICT A UHPC LINK SLAB INSTALLED IN AN EXISTING CAST-IN-PLACE DECK. SIMILAR DETAILS SHALL BE USED FOR PRECAST DECK PANELS.

NOTES:

1. COMPRESSED SYNTHETIC SHEET GASKET (0.0625 INCH THICK SHEET, TREATED BOTH SIDES), CONFORMING TO MATERIAL SPECIFICATION 728-06, SHALL COVER THE ENTIRE SURFACE OF RECONSTRUCTED DECK ENDS, OR PRECAST PANEL ENDS, WITHIN THE DEBONDED ZONE. COST TO BE INCLUDED IN THE UNIT PRICE BID FOR THE CONCRETE ITEM.
2. DEBOND ALL REINFORCEMENT THAT EXTENDS OUT OF THE UHPC LINK SLAB WITHIN THE DEBONDED ZONE AS INDICATED IN THE DETAILS. DEBONDING SHALL BE ACCOMPLISHED BY WRAPPING BARS WITH A MINIMUM OF 3 LAYERS OF HEAVY DUTY DUCT TAPE.
3. BOND BREAKER USED AT THE INTERFACE OF THE LINK SLAB AND BARRIER, SIDEWALK, OR BRUSH CURB SHALL BE SIKKA BONDBREAKER W, WAX BASED BOND BREAKER MATERIAL, OR APPROVED EQUAL.
4. THE COST OF THE HYDROPHILIC CAULK/SEAL SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE LINK SLAB CONCRETE ITEM. THE CAULK/SEAL MANUFACTURER AND INSTALLATION SHALL BE APPROVED BY THE ENGINEER. THE HYDROPHILIC CAULK/SEAL SHALL BE PROTECTED FROM THE APPLICATION OF THE BOND BREAKER MATERIAL.
5. THE BARS SHOWN IN THE BARRIER ARE THE ANCHORAGE BARS ORIGINATING IN THE DECK. FOR BARRIER REINFORCEMENT DETAILS SEE THE BD-RCB SERIES.

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		UHPC LINK SLAB DETAILS (2 OF 2)	
ERRATA			
	APPROVED: / /	ORIGINAL ISSUED UNDER EB	
	ORIGINAL SIGNED BY	CURRENT ISSUED UNDER EB	
	DEPUTY CHIEF ENGINEER (STRUCTURES)	EFFECTIVE WITH THE LETTING OF / /	

SLIDING EXPANSION ELASTOMERIC BEARING (TYPE E.B.) TABLE

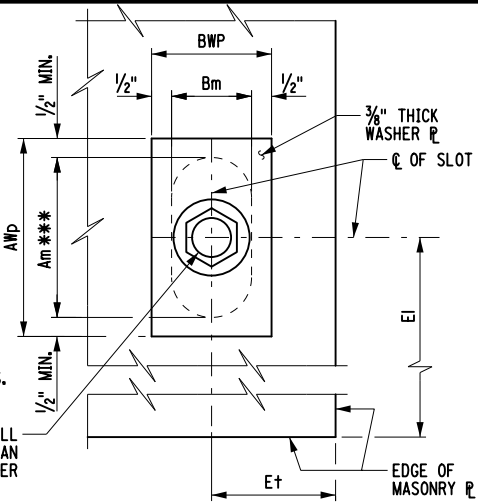
SLIDING EXPANSION ELASTOMERIC BEARING (TYPE E.B.) TABLE																																					
LOCATION	ITEM NO.	QUANTITY REQUIRED	D.L. + S.D.L. (kips)	L.L. WITHOUT IMPACT (kips)	TOTAL DESIGN REACTION (kips)	SHAPE FACTOR	ELASTOMER LAYER					hr †	COMP. AREA (Sq. In.)	SHEAR AREA (Sq. In.)	* (G) GUIDE CLEARANCE	MASONRY PLATE								ANCHOR STUDS		WELD SIZE		WASHER PLATE		SOLE PLATE				LOAD PLATE			BRG. H
							THK/LAYER	NO. LAYERS	L	W	D					Wm	Lm	Tm	Et	Ei	Ez	Am	Bm	DIA.	STUDS/BRG.	A	B	AWp	BWp	Ws	Ls	T1	T2	W1	L1	T1	

TABLE DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

T2 IS UPSTATION OF T1.

* - STANDARD GUIDE CLEARANCE SHALL BE 1/8" FOR STRUCTURES LESS THAN 40' WIDE. FOR STRUCTURES WIDER THAN 40' OR CURVED STRUCTURES WHERE LATERAL MOVEMENTS ARE EXPECTED, THE DESIGNER SHALL SPECIFY THE REQUIRED "GUIDE CLEARANCE".

*** - LENGTH OF SLOT SHALL BE PARALLEL TO STRAIGHT BEAMS AND ALONG THE CHORD TO THE FIXED BEARING ON CURVED BEAMS.



TYPICAL SLOTTED HOLE DETAIL MASONRY PLATE

DESIGNER NOTES:

ANCHOR STUD SHALL BE 1" DIA. MINIMUM. FOR ANCHOR STUD DETAILS, SEE BD-BG6E.

DESIGNER SHALL DETERMINE SIZE OF SOLE PLATE TO FLANGE WELD (A). OTHER METHODS OF ATTACHMENT ARE ALLOWED AS AN ALTERNATE WITH D.C.E.S. APPROVAL. SEE BD-BG6E FOR DETAILS.

X = MAXIMUM DESIGN MOVEMENT ROUNDED UP TO THE NEXT 1/2".

MINIMUM EDGE DISTANCES FOR DESIGN:

Et = 1.75 X STUD DIA. + 1/4"

Ei = 1.75 X STUD DIA. + 1 1/2"

Øm = STUD DIA. + 3/8"

MIN. CLEARANCE FROM Ø OF ANCHOR STUD TO SOLE PL = Ez = STUD DIA. + 3/8".

hr† = TOTAL ELASTOMER HEIGHT (NUMBER OF ELASTOMER LAYERS X HEIGHT OF 1 LAYER)

A TAPERED SOLE PLATE MAY BE REQUIRED WHEN THE BOTTOM OF THE BEAM/GIRDER AND THE TOP OF BEARINGS ARE NOT PARALLEL TO EACH OTHER. THE SOLE PLATE SHALL BE TAPERED IF EITHER OF THE FOLLOWING CONDITIONS EXIST:

- 1) LONGITUDINAL GRADE OF THE BOTTOM FLANGE IS ONE PERCENT OR MORE.
- 2) THE REQUIRED TAPER IS 1/8" OR MORE.

DO NOT INCLUDE THE BEARING PAD THICKNESS WHEN CALCULATING THE BEARING HEIGHT (H).

DESIGNERS SHALL USE 50 OR 60 DUROMETER HARDNESS IN THE BEARING DESIGN AND ADD NUMBERS USED TO THE NOTE BELOW.

NOTES:

THE BEARINGS SHALL MEET THE REQUIREMENTS OF STANDARD SPECIFICATION SECTION 565 UNLESS OTHERWISE NOTED.

ALL ELASTOMER SHALL BE DUROMETER HARDNESS ON THE SHORE A SCALE.

ALL STEEL EXCEPT THE INTERNAL STEEL PLATES SHALL CONFORM TO ASTM A709, GR. 50, UNLESS OTHERWISE NOTED.

BEARING PADS SHALL CONFORM TO ONE OF THE FOLLOWING MATERIAL SPECIFICATIONS: 728-01, 728-02 OR 728-03.

INSTALLATION ALIGNMENT: THE MAXIMUM VARIATION FROM PERFECT ALIGNMENT UNDER FULL DEAD LOAD SHALL NOT EXCEED 1/8". THIS VARIATION SHALL BE MEASURED AS THE HORIZONTAL DISTANCE BETWEEN THE CENTERLINE OF THE HIGHEST ELASTOMER SURFACE AND THE CENTERLINE OF THE LOWEST ELASTOMER SURFACE.

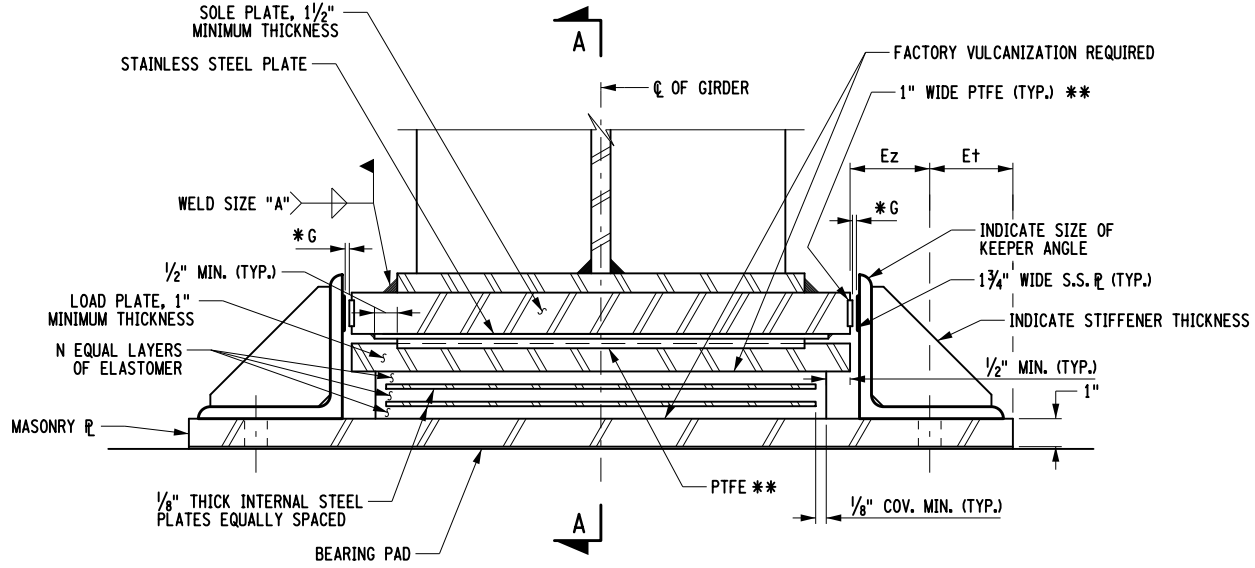
CONCRETE SURFACES UNDER THE BEARINGS SHALL CONFORM TO SUBSECTION 565-3.02 "CONCRETE BEARING SURFACE PREPARATION" OF THE NEW YORK STATE STANDARD SPECIFICATIONS, CONSTRUCTION AND MATERIALS.

THE BEARING PAD, ANCHOR STUDS WASHER PLATES AND NUTS SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE BEARING ITEM.

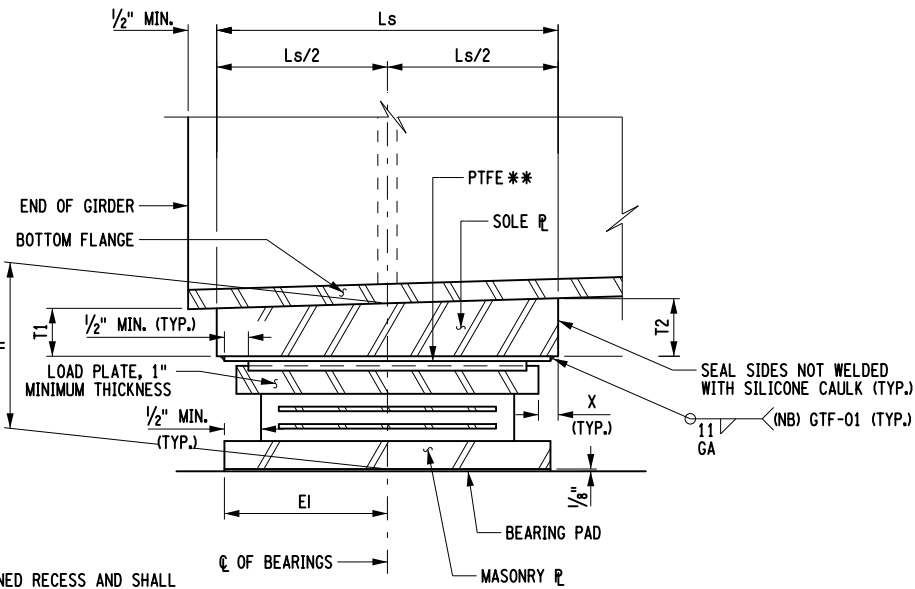
ALL STAINLESS STEEL PLATES SHALL BE ASTM A240 TYPE 304, #8 AND 2B FINISH, AND A MINIMUM THICKNESS OF 0.12".

PTFE SHALL BE VIRGIN, UNFILLED POLYTETRAFLUORETHYLENE, AND A MINIMUM THICKNESS OF 0.188". RESIN FOR THE PTFE SHALL SATISFY THE REQUIREMENTS OF ASTM D4894.

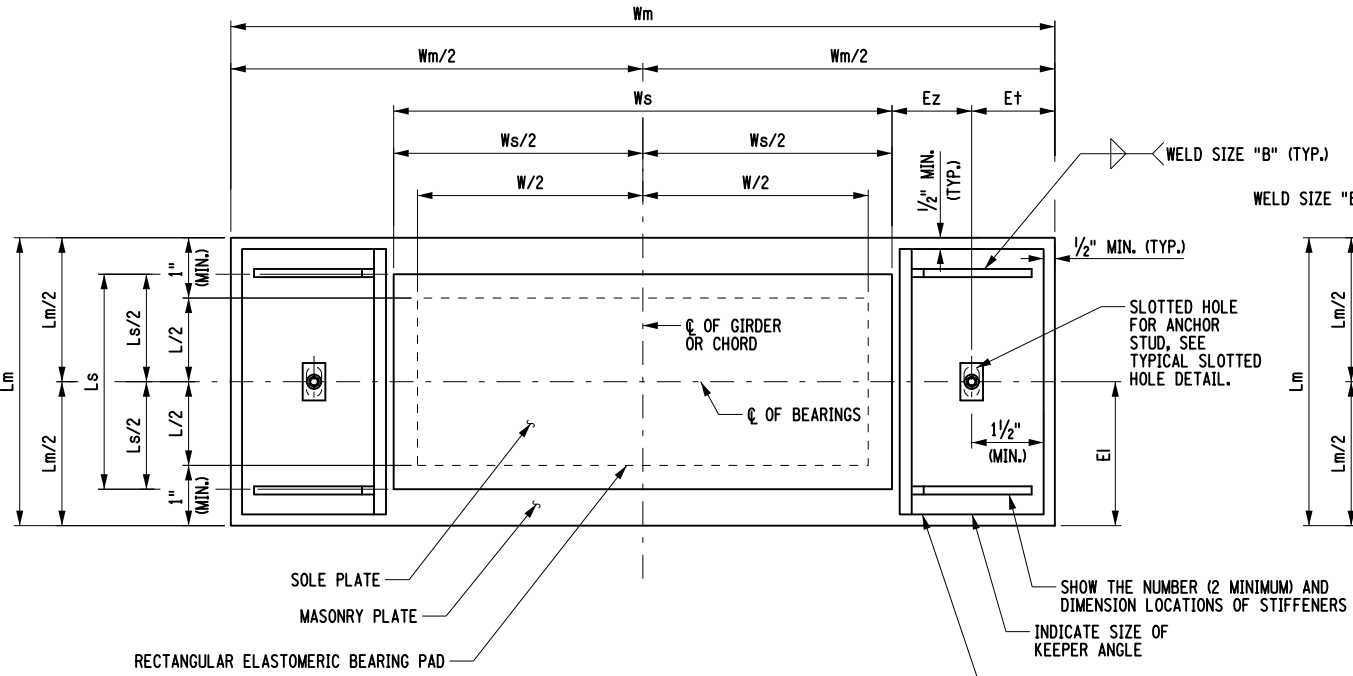
REVISED		Department of Transportation Office of Structures
ERRATA		
APPROVED: / / ORIGINAL SIGNED BY:		ORIGINAL ISSUED UNDER EB
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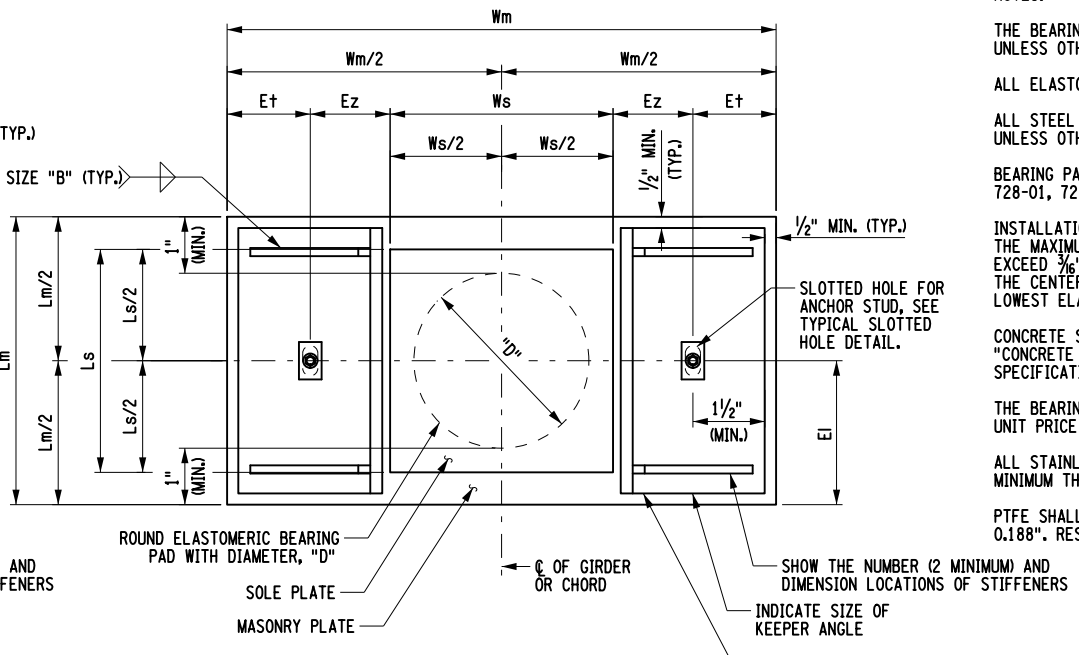
ELEVATION
TYPICAL SLIDING EXPANSION BEARING



SECTION A-A



PLAN
TYPICAL RECTANGULAR SLIDING EXPANSION BEARING



PLAN
TYPICAL CIRCULAR SLIDING EXPANSION BEARING

** - PTFE SHALL BE SET INTO A MACHINED RECESS AND SHALL BE ETCHED ON ONE SIDE TO AID BONDING FOR RECESS. DEPTH OF MACHINED RECESS SHALL BE 1/2 THE THICKNESS OF THE PTFE. STEEL MATING SURFACE OF PTFE SHALL BE GRIT BLASTED AND GREASED PRIOR TO ASSEMBLY.

INDICATE WELD SIZE (TYP.) AS AN ALTERNATE TO WELDING, KEEPER ANGLES MAY BE BOLTED (MINIMUM OF 2 BOLTS PER ANGLE) TO THE MASONRY PLATE.

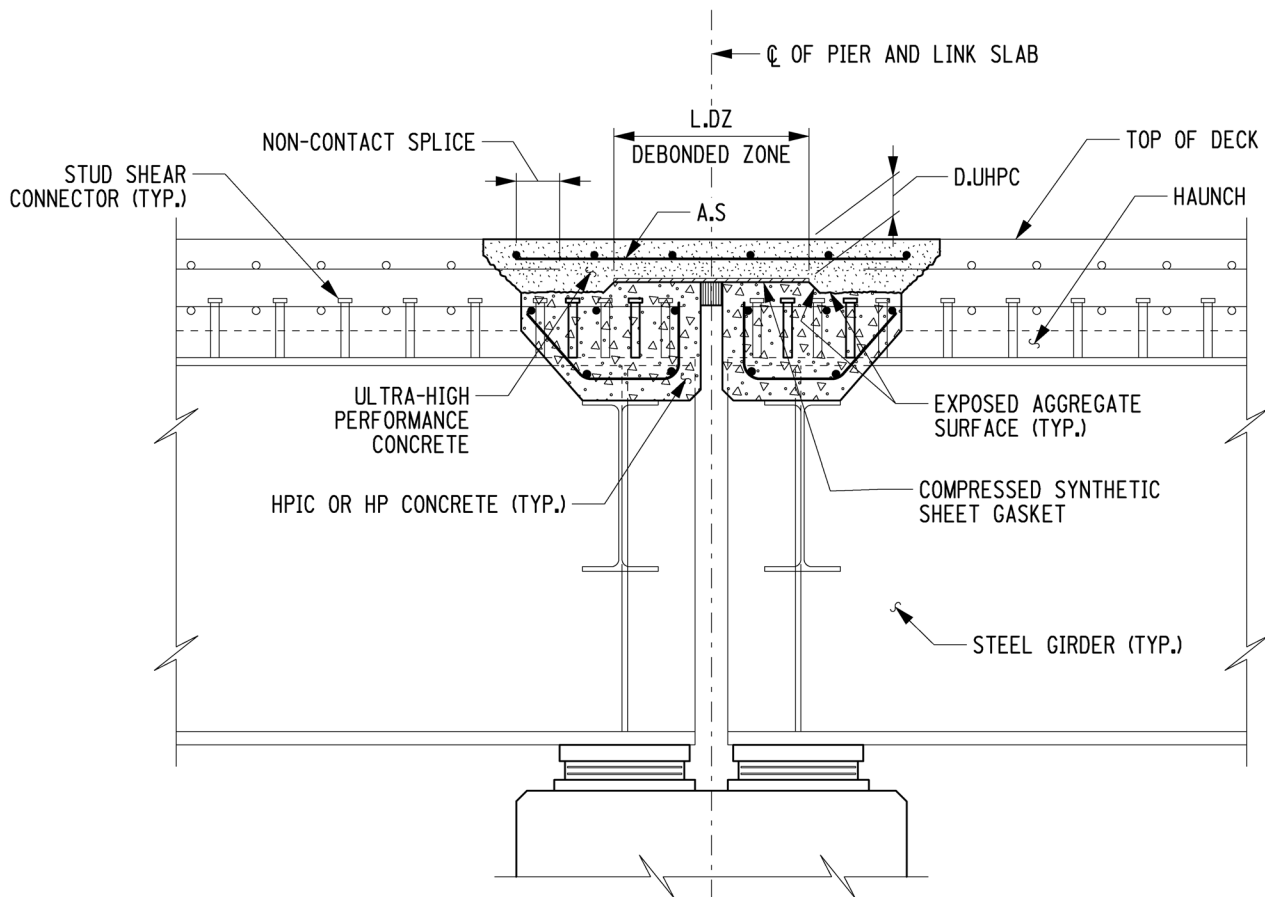
INDICATE WELD SIZE (TYP.) AS AN ALTERNATE TO WELDING, KEEPER ANGLES MAY BE BOLTED (MINIMUM OF 2 BOLTS PER ANGLE) TO THE MASONRY PLATE.

EXAMPLE

The NYSDOT Office of Structures has developed an innovative link slab design utilizing Ultra-High Performance Concrete (UHPC). The results of our investigation into the behavior of UHPC link slabs showed that the force required to strain the UHPC in pure tension is extremely large and nearly all of the translation, due to the girder's end rotation, will occur at the bearings. Therefore, the link slab design assumes that the UHPC section is subject to bending only. Although not accounted for in the design of the link slab, due to the conservative approach taken for bending, the link slab also acts as a semi-rigid link that transfers lateral loads between spans.

Our design uses a strain based analysis, where the extreme fiber tensile strain in the UHPC is determined by the amount of girder end rotation, under the assumption of linearly elastic flexural behavior. Using stress-strain relationships, the location of the neutral axis is found through an iterative algorithm. Upon convergence of the assumed and calculated neutral axis location, the tensile strain and compressive stress in the UHPC, along with the stress in the longitudinal steel reinforcement, is computed and compared to allowable values.

In tension, UHPC develops closely spaced micro-cracks as a result of its high strength steel fibers being dispersed throughout a matrix of fine aggregates and supplementary cementitious materials. Due to this unique tensile behavior, UHPC has the ability to withstand ultimate tensile strains up to 0.007. It is this attribute that allows UHPC link slabs to accommodate the girder's end rotations within a relatively short length. For design, a maximum strain of 0.0035 at the extreme tensile fiber was chosen in order to limit the crack widths to a level that will not permit the penetration of moisture and chlorides, ensuring a highly durable solution for the elimination of deck joints.



EXAMPLE

User Inputs

- Indicates user input

$f_y := 60\text{ksi}$ reinforcement yield strength

Note: The following inputs are standard and not editable by the user.

$E_s := 29000\text{ksi}$ reinforcement modulus of elasticity (LRFD 5.4.3.2)

$E_c := 8000\text{ksi}$ UHPC compressive modulus of elasticity

$A_s := \frac{0.31\text{in}^2}{8\text{in}} = 0.47 \cdot \frac{\text{in}^2}{\text{ft}}$ area of longitudinal reinforcement at joint

$f_{\text{uhpc.t.all}} := 1.2\text{ksi}$ UHPC tensile cracking stress

$\theta_{LL} := 0.00506\text{rad}$ unfactored live load girder end rotation (use average rotation of linked spans if they are not equal)

$f_{\text{uhpc.c.all}} := -14\text{ksi}$ maximum allowable UHPC compressive stress

$L_{dz} := 16\text{in}$ debonded zone length

$\epsilon_{\text{uhpc.t.all}} := 3500 \cdot 10^{-6}$ maximum allowable UHPC tensile strain

$d_{bf} := 6.32\text{ft}$ vertical distance from top of deck to bottom of bottom flange

$d_{\text{uhpc}} := 4\text{in}$ depth of UHPC

Flexural Analysis of Link Slab

$b := 1\text{ft}$ width of section

$h := d_{\text{uhpc}} = 4.0\text{in}$ depth of UHPC

$A_s := A_s \cdot b = 0.47 \cdot \text{in}^2$ area of reinforcement within section

$f_t := f_{\text{uhpc.t.all}} = 1.2\text{ksi}$ assumed maximum tensile stress of UHPC

$c :=$
 $eci \leftarrow 1 \cdot 10^{-6}$
 $ec \leftarrow 1$
 $i \leftarrow 1$
 iterative algorithm to determine distance from bottom of section to neutral axis

$\theta := 1.75 \cdot \theta_{LL} = 0.51 \cdot \text{deg}$ Strength I girder end rotation

while $eci < |ec|$

$fc \leftarrow eci \cdot E_c$

$c \leftarrow \frac{\sqrt{A_s^2 \cdot E_s^2 \cdot eci^2 + fc \cdot A_s \cdot E_s \cdot b \cdot h \cdot eci + b^2 \cdot f_t^2 \cdot h^2} + b \cdot f_t \cdot h - A_s \cdot E_s \cdot eci}{b \cdot fc + 2 \cdot b \cdot f_t}$

$ec \leftarrow \frac{-2 \cdot \theta \cdot c}{L_{dz}}$

$eci \leftarrow eci + 0.1 \cdot 10^{-6}$

$i \leftarrow i + 1$

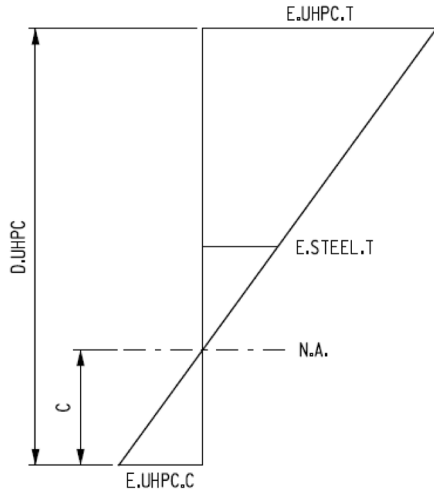
out \leftarrow "Error" if $(c < 0\text{in}) \vee (c > d_{\text{uhpc}}) \vee \left(\frac{\max(|ec|, eci)}{\min(|ec|, eci)} - 1 > 5\% \right)$

out $\leftarrow c$ otherwise

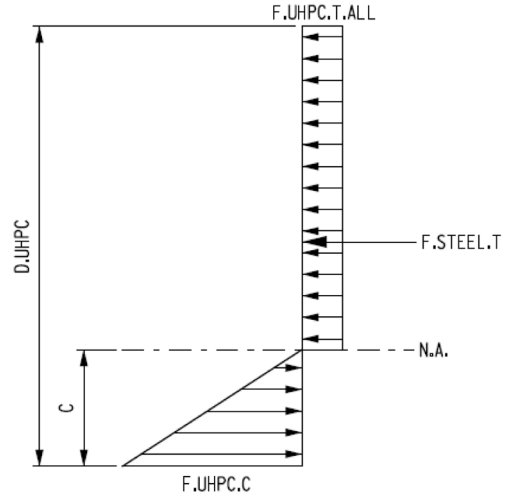
return out

EXAMPLE

Strain Diagram



Stress Diagram



$c = 1.04 \cdot \text{in}$ distance from bottom of section to neutral axis

$$\epsilon_{\text{uhpc.t}} := \frac{2 \cdot \theta \cdot (d_{\text{uhpc}} - c)}{L_{\text{dz}}} = 3280 \cdot 10^{-6} \quad \text{tensile strain in UHPC}$$

$$\epsilon_{\text{s.t}} := \frac{2 \cdot \theta \cdot \left(\frac{d_{\text{uhpc}}}{2} - c \right)}{L_{\text{dz}}} = 1067 \cdot 10^{-6} \quad \text{tensile strain in reinforcement}$$

$$f_{\text{s.t}} := \epsilon_{\text{s.t}} \cdot E_s = 30.93 \cdot \text{ksi} \quad \text{tensile stress in reinforcement}$$

$$\epsilon_{\text{uhpc.c}} := \frac{-2 \cdot \theta \cdot c}{L_{\text{dz}}} = -1147 \cdot 10^{-6} \quad \text{compressive strain in UHPC}$$

$$f_{\text{uhpc.c}} := \epsilon_{\text{uhpc.c}} \cdot E_c = -9.18 \cdot \text{ksi} \quad \text{compressive stress in UHPC}$$

$$d_{\text{gap.min}} := 2 \cdot \theta \cdot [d_{\text{bf}} - (d_{\text{uhpc}} - c)] = 1.29 \cdot \text{in} \quad \text{minimum required girder end gap}$$

Analysis Results

	"Analysis Criteria"	"Actual"	"Allowable"	"Design Ratio"	"Pass/Fail"
R =	"Tensile Strain in UHPC ($\mu\epsilon$)"	3280.41	3500.00	1.07	"Pass"
	"Stress in Reinforcement (ksi)"	30.93	60.00	1.94	"Pass"
	"Compressive Stress in UHPC ($\mu\epsilon$)"	-9.18	-14.00	1.53	"Pass"
	"Minimum Girder End Gap (in)"	"---"	1.29	"---"	"---"

Restoration Plans

Figure 1: Wetland and Surface Water Restoration Work

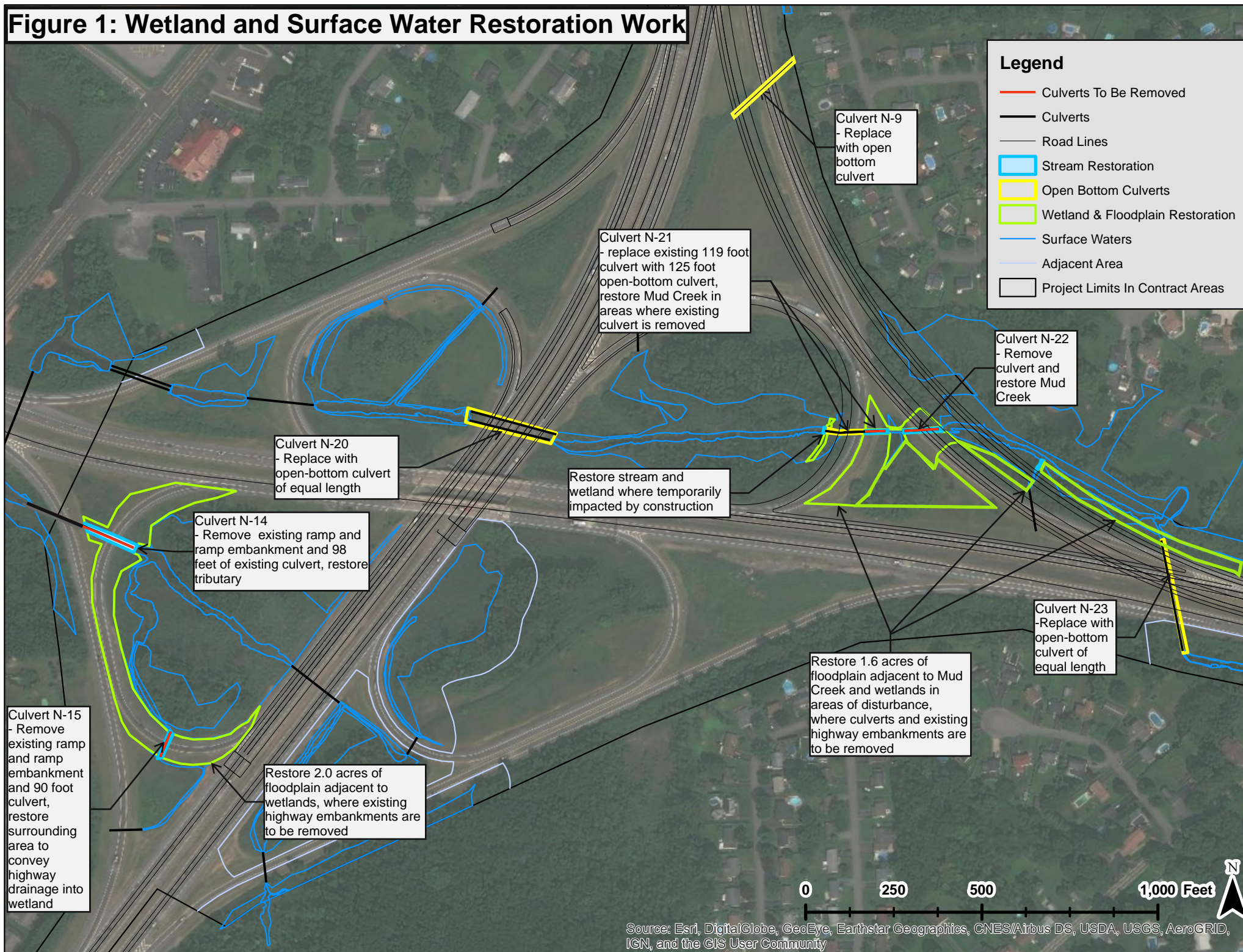
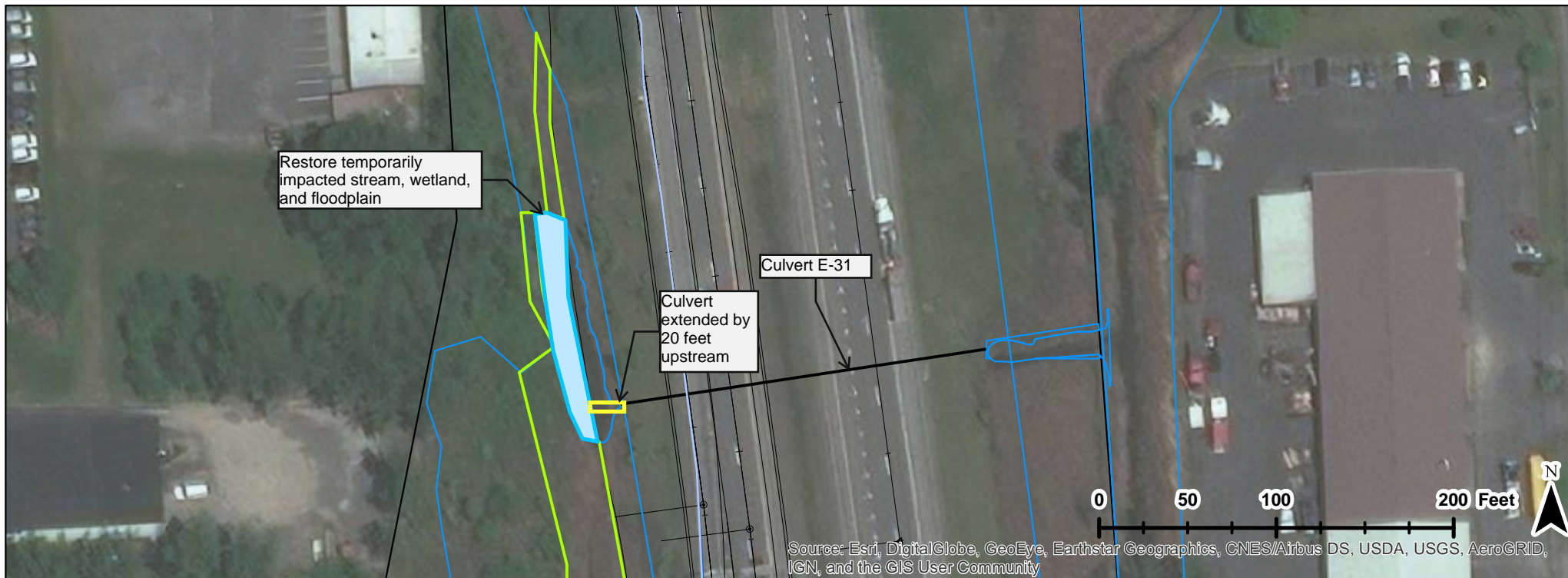
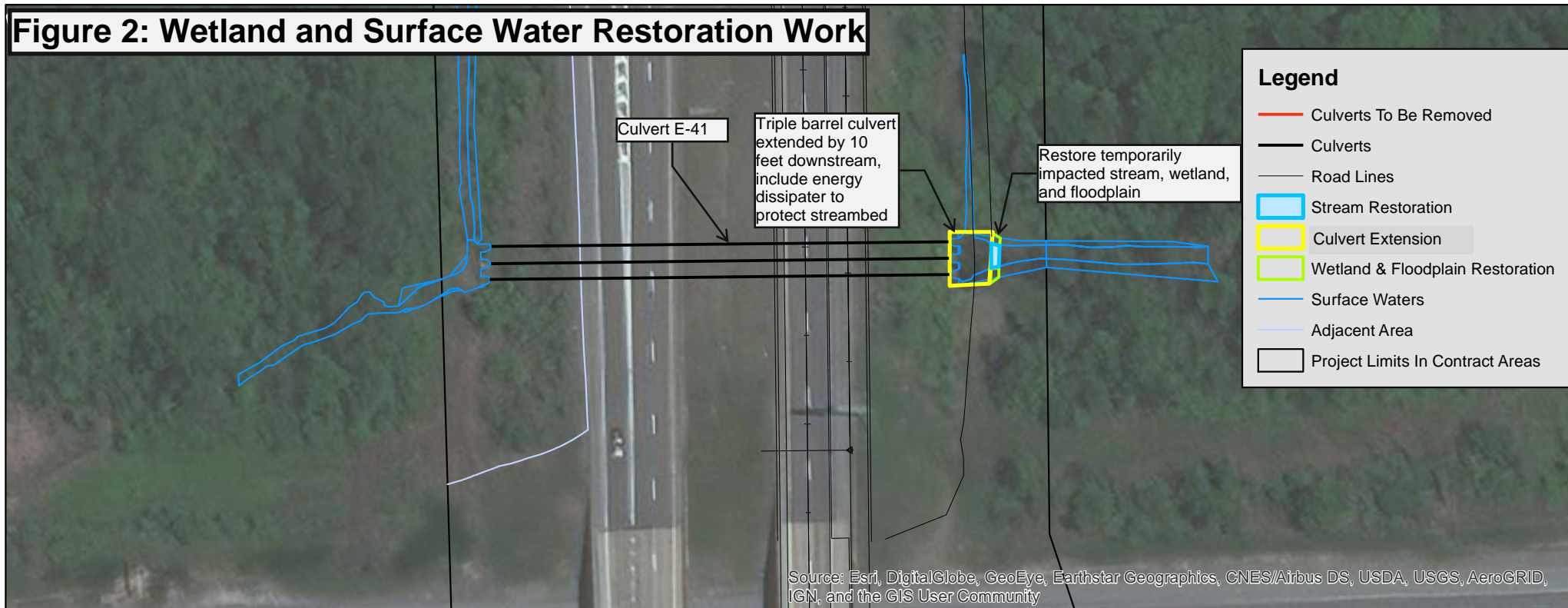


Figure 2: Wetland and Surface Water Restoration Work



General Ecology - Culverts	Action Summary	NYSDOT Standard Specifications	Special Specifications
Outfall-N-1	Pipe replacement	Section 206 Trench, Culvert, and Structure Excavation	A highway drainage pipe (ex. 24" RCP), Outfall-N-1, that currently outlets into dry swale densely populated with common reed (in triangular interchange area north of Mud Creek/Wetland 10L, where an infiltration or detention basin is proposed) would be reconstructed and extended during HWY ROW reconstruction.
Outfall N-2	Pipe replacement	Section 206 Trench, Culvert, and Structure Excavation, may need Special spec 555.10000006 Abandon Existing Culvert	A highway drainage pipe (ex. 36" CMP), Outfall-N-2, that currently outlets to a steep wet-weather-flow tributary to Mud Creek would be relocated, requiring the construction of a new drainage pipe. There is erosion downstream of the existing outfall; the Design-Builder shall conduct a H&H analysis to ensure no erosion will occur downstream of the new drainage pipe and/or install outfall protection, an energy dissipator, and/or possibly lightly reinforce the ex channel downstream of the outfall. Coordination with the Geotechnical Consultant is recommended.
Culvert E-41	Culvert extension	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam	Design-Builder shall extend the existing triple barrel culvert structure 10 feet downstream into the unnamed tributary to North Branch Ley Creek, creating 134 linear feet of additional culvert and reducing the creek length to 40 linear feet, and reduce the surface water area to 400 square feet. The extended culvert outfall shall include an energy dissipator or similar to protect the streambed downstream of the culvert from erosion. NYSDOT specifies that the width of the structure shall be 1.25 times the normal width of the streambed. The overall culvert capacity should be able to accommodate expected high flows. There is a special spec for extension of a CMP culvert with a paved invert; this could be potentially be modified for this culvert (603.07911806)
Culvert E-31	Culvert extension	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam	Design-Builder shall extend culvert by 20 feet into the upstream wetland area. NYSDOT specifies that rip rap shall be used as head wall protection to prevent scouring around the inlet and outlet of the culvert.
Culvert N-6	Replace with Open Bottom Culvert	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam, Section 620 Bank and Channel Protection	Design-Builder shall extend culvert by 21 feet to connect with the existing wetland; at minimum, the culverts must have a width at bankfull (1.25 x Bankfull width) and would be embedded at least 20 percent at the inlet
Culvert N-8	Replace with Open Bottom Culvert	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam, Section 620 Bank and Channel Protection	The Design-Builder shall extend the culvert by 64 feet to accommodate the new HWY ROW and safely convey the South Branch of Pine Grove Brook; at minimum, the culverts must have a width at bankfull (1.25 x Bankfull width) and would be embedded at least 20 percent at the inlet
Culvert N-9	Replace with Open Bottom Culvert	Section 206 Trench, Culvert, and Structure Excavation	The Design-Builder shall replace the existing culvert with an open bottom culvert, and extend the length by 75 feet into the triangular interchange area to accommodate the new highway geometry
Culvert N-14	Demolish ramp, ramp embankment, and 98 feet of existing culvert	Section 206 Trench, Culvert, and Structure Excavation, Special spec 555.10000006 Abandon Existing Culvert	The Design-Builder shall remove the existing ramp and culvert and grade the areas in order to implement the Restoration Plan. Culvert N-14 is currently 234 linear feet, 98 linear feet of which would be removed from the demolition area (the remainder of the pipe is needed to maintain drainage patterns under the remaining HWY ROW ramp.)
Culvert N-15	Demolish ramp, ramp embankment, and existing 90 foot Culvert	Section 206 Trench, Culvert, and Structure Excavation, Special spec 555.10000006 Abandon Existing Culvert	The Design-Builder shall remove the existing ramp and 80 foot long culvert and grade the areas in order to implement the Restoration Plan.
Culvert N-20	Replace with Open Bottom Culvert	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam	The Design-Builder shall replace the existing culvert with an open bottom culvert. At minimum, the culvert must have a width at bankfull (1.25 x Bankfull width) and would be embedded at least 20 percent at the inlet. Design-Builder shall use H&H modeling to ensure sufficient capacity for bankfull storm event and flood events. Current culvert sizes may be too small. Inlets and outlets need to be embedded in the embankment and protected with riprap to prevent scour - H&H modeling will help determine erosive forces and extent of protection needed. Any area disturbed during construction shall be stabilized after.
Culvert N-21	Replace with Open Bottom Culvert, further downstream from original culvert, to accommodate new ROW geometry	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam	The Design-Builder shall replace the existing culvert with an open bottom culvert. At minimum, the culvert must have a width at bankfull (1.25 x Bankfull width) and would be embedded at least 20 percent at the inlet. The Design-Builder shall shift the Culvert N-21 downstream. The open bottom culvert would be 6 feet longer than the existing culvert. It would result in a decrease in length to the section of Mud Creek between N-21 and N-20, which is currently 839 linear feet (0.40 acres) and would be reduced to 795 linear feet (0.38 acres). This would result in a 44 linear foot decrease in length, or 0.02 acres of surface water.
Culvert N-23 and N-21	Bridge and retaining wall construction	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Coffor Dam	The Design-Builder shall construct a new bridge between the existing N-23 and N-21 culverts. The Design-Builder shall avoid bridge construction in any portions of Mud Creek and shall avoid raising the floodplain where possible.

Culvert N-23	Replace with Open Bottom Culvert	Section 206 Trench, Culvert, and Structure Excavation, Special spec 553.010001 Cofferdam	The Design-Builder shall replace the existing culvert with an open bottom culvert of equal length. At minimum, the culvert must have a width at bankfull (1.25 x Bankfull width) and would be embedded at least 20 percent at the inlet. Design-Builder shall size culverts using H&H modeling to ensure sufficient capacity for bankfull storm event and flood events. Current culvert sizes may be too small. Inlets and outlets need to be embedded in the embankment and protected with riprap to prevent scour - H&H modeling will help determine erosive forces and extent of protection needed. Any area disturbed during construction shall be stabilized after.
Floodplain Restoration associated with removal of existing ramp, ramp embankment, and culverts N-14 and N-15	Restore 2.0 acres of floodplain associated with a tributary to Mud Creek associated with Culverts N-14 and N-15)	Section 610 - Ground Vegetation - Preparation, Establishment and Management (All subsections except 1.02, 1.03, 1.12, 1.13, 2.03, 2.05, 2.12, and 2.13); Section 611 - Planting, Transplanting And Post Planting Care; Section 713 Landscape Development Materials	The Design-Builder shall develop a Restoration Plan for wetland, channel, and floodplain areas that would be temporarily disturbed during construction and/or for the channel and floodplain areas that have been identified for restoration. One section of the Restoration Plan shall include the restoration of the floodplain. At minimum, 2.0 acres of floodplain would be restored. The Design-Builder shall identify a reference floodplain and justification for its use and present it to NYSDEC for review and approval. One of the goals and objectives will be to grade the land to fully reconnect the adjacent wetland. The Restoration Plan shall establish goals and objectives as part of the Restoration Plan for review and approval by NYSDEC. At minimum, the entire restoration area shall be seeded at a rate specified by 610-3.04. Plugs and vines and groundcovers shall be planted at a rate of 1 plant per 4 sq. feet. Trees and shrubs at a rate of no less than 350 bare root plants per acre. At minimum, herbaceous plugs shall be spaced no more than 18" apart. The Design-Builder shall develop a Monitoring and Adaptive Management Plan as part of the development of the Restoration Plan. The Design-Builder shall follow all permit conditions outlined in the NYSDEC/USACE permits, including the Performance Standards established as part of the Monitoring and Adaptive Management Plan. At minimum, the Performance Standards shall stipulate that plant survival shall not be less than 85% after the five-year monitoring period and shall not be less than 85% for three or more consecutive years within the five-year monitoring period. Invasive species (specifically Phragmites australis) shall not exceed 5% at the end of the five-year monitoring period.
Culvert N-22	Remove culvert and restore 250 feet of Mud Creek and associated wetland	Section 610 - Ground Vegetation - Preparation, Establishment and Management (All subsections except 1.02, 1.03, 1.12, 1.13, 2.03, 2.05, 2.12, and 2.13); Section 611 - Planting, Transplanting And Post Planting Care; Section 713 Landscape Development Materials; Special spec for fine channel grading (from Gay's Point project)	The Design-Builder shall develop a Restoration Plan for wetland, channel, and floodplain areas that would be temporarily disturbed during construction and/or for the channel and floodplain areas that have been identified for restoration. One section of the Restoration Plan will include the channel and riparian buffer restoration of Mud Creek. Mud Creek channel restoration will mimic an upstream portion of Mud Creek. The Design-Builder shall select a reference condition and justification for its use as part of its development of the Restoration Plan and the Restoration Plans goals and objectives. Only native species, including native aquatic plants, shall be used in the restoration plan. The Design-Builder shall submit the restoration plan to NYSDEC for approval. The vegetated buffer shall have a minimum width of 50' where space is limited and shall follow the Three Zone Concept outlined in NYSDEC Riparian Buffers guidance (https://www.dec.ny.gov/chemical/106345.html). Where possible, the vegetated buffer shall be 100' wide to meet NYSDEC's riparian corridor guidance. The Design-Builder shall develop a Monitoring and Adaptive Management Plan as part of the development of the Restoration Plan. The Design-Builder shall follow all permit conditions outlined in the NYSDEC/USACE permits, including the Performance Standards established as part of the restoration monitoring plan. At minimum, the Performance Standards shall stipulate that plant survival shall not be lower than 85% after the five year monitoring period and shall not be lower than 85% for three or more consecutive years within the five year period. Invasive species (specifically Phragmites australis) shall not exceed 5% at the end of the five year monitoring period.

Floodplain restoration associated with removal of Culverts N-21 and N-22 and associated existing highway embankments	Restore 1.6 acres of floodplain adjacent to mainstem of Mud Creek	Section 610 - Ground Vegetation - Preparation, Establishment and Management (All subsections except 1.02, 1.03, 1.12, 1.13, 2.03, 2.05, 2.12, and 2.13); Section 611 - Planting, Transplanting And Post Planting Care; Section 713 Landscape Development Materials	The Design-Builder shall develop a Restoration Plan for wetland, channel, and floodplain areas that would be temporarily disturbed during construction and/or for the channel and floodplain areas that have been identified for restoration. One section of the Restoration Plan shall include the restoration of the floodplain. At minimum, 1.6 acres of floodplain would be restored. The Design-Builder shall identify a reference floodplain and present the reference floodplain to NYSDEC for review and approval. One of the goals and objectives will to grade the land to fully reconnect the adjacent wetland. The Restoration Plan shall establish goals and objectives as part of the Restoration Plan for review and approval by NYSDEC. At minimum, the entire restoration area shall be seeded at a rate specified by 610-3.04. Plugs and vines and groundcovers shall be planted at a rate of 1 plant per 4 sq. feet. Trees and shrubs at a rate of no less than 350 bare root plants per acre. At minimum, herbaceous plugs shall be spaced no more than 18" apart. The Design-Builder shall develop a Monitoring and Adaptive Management Plan as part of the development of the Restoration Plan. The Design-Builder shall follow all permit conditions outlined in the NYSDEC/USACE permits, including the Performance Standards established as part of the Monitoring and Adaptive Management Plan. At minimum, the Performance Standards shall stipulate that plant survival shall not be lower than 85% after the five year monitoring period and shall not be lower than 85% for three or more consecutive years within the five year period. Invasive species (specifically <i>Phragmites australis</i>) shall not exceed 5% at the end of the five year monitoring period.
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Hazardous Waste Contaminated Materials Additional Information



Memorandum

To: File

From: Justin Kellogg, M.S., QEP, Senior Environmental Engineer

Date: May 12, 2022

Subject: I-81 VIADUCT PROJECT - PHASE 1, CONTRACT 1
PIN 3501.90, Contract D900054
Hazardous Waste/Contaminated Materials Additional Information for Contract 1 RFP
Watts Project Number 13092

The purpose of this Memorandum is to identify additional information that would assist in the bidding process for the I-81 Viaduct Project - Phase 1, Contract 1 Request for Proposal (RFP).

Hazardous waste/contaminated materials assessments have identified those properties where either contaminated soils and groundwater or underground storage tanks primarily used for petroleum sales are suspected to be present. Information describing the specific sites of concern is found in the Hazardous Waste/Contaminated Materials Screening Assessment Report dated February 2020 and the stand-alone Phase I Environmental Site Assessment for Proposed Noise Walls 16 A/B Memorandum dated May 17, 2021. The aforementioned documents were prepared for a larger project footprint than the Contract 1 project limits. This Memorandum identifies the sites of potential environmental concern that are found within or adjacent to the Contract 1 project limits. Please refer to the abovementioned documents for additional information on the sites of potential environmental concern.

The 18 sites in the table below are in the vicinity of the Design-Build Contract 1 project corridor and were identified as potentially contaminated; however, only one site (3.2.5, CSX: DeWitt Railroad Yard - shown in bold below) is considered to have a high probability of contamination being present.

The 17 other sites in the table below are considered to have a low probability of contamination and are called out as an advisory that the Design-Builder should be on the lookout and aware of the potential for contamination in the vicinity of these sites.

Site ID #	Property Name and Address	Current or Former Use	Potential Environmental Concerns	Notes
3.1.1	I-81: Sutton Dr - I-481 Interchange & I-481: I-81 Interchange - Northern Blvd	Roadway Corridor	Petroleum Contamination	Roadway corridor, spills are too scattered to identify them specifically.

I-81 VIADUCT PROJECT - PHASE 1, CONTRACT 1

PIN 3501.90, Contract D900054

Hazardous Waste/Contaminated Materials Additional Information for Contract 1 RFP

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Site ID #	Property Name and Address	Current or Former Use	Potential Environmental Concerns	Notes
3.1.2	Burdick Auto Dealer: 5947 Circle Dr	Automobile Related	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Noise barrier installation disturbance is within the ROW and close to highway. Contamination, if present, is likely off the ROW.
3.1.3	Burdick Auto Dealer: 5857-5927 Circle Dr	Automobile Related, USTs	Petroleum Contamination, USTs	Soil disturbance is within the highway ROW and likely tank/spill sites are far from the ROW.
3.1.4	National Grid: 7496 Round Pond Rd	Natural Gas Fueling Station	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Disturbed area is within the ROW. Past spills were off of the highway ROW, small and mostly cleaned/closed.
3.1.5	Swift Transportation: 7470 Round Pond Rd	Automobile Related, USTs	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Soil disturbance is within the highway ROW and likely tank/spill sites are far from the ROW.
3.1.6	Monroe Tractor & Implement: 7300 Eastman Rd	Automobile Related	Petroleum Contamination	Soil disturbance is within the highway ROW and likely spill sites are far from the ROW.
3.1.7	Lan-Co Companies: 7330 Eastman Rd	Solid Waste Landfill	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Soil disturbance is within the highway ROW and likely spill sites are far from the ROW.
3.2.1	I-481: I-90 - Route 592 Interchange	Roadway Corridor	Chemical/Solvent Contamination, Petroleum Contamination	Roadway corridor, spills are too scattered to identify them specifically.
3.2.2	Inficon Inc: 2 Technology Pl	Manufacturing Facility and USTs	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Soil disturbance is within the highway ROW and likely tank/spill sites are far from the ROW.
3.2.3	Joy Process Mechanical 6747 Benedict Rd	Manufacturing Facility	Chemical/Solvent Contamination	Edge of disturbance area, but no ROW takes and started in 1986 (farmed prior) and no tanks.
3.2.4	Ultra Dairy: 6750 Benedict Rd	Manufacturing Facility and USTs	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Edge of disturbance area, but no ROW takes and tanks are ASTs, few, and somewhat recent.

I-81 VIADUCT PROJECT - PHASE 1, CONTRACT 1

PIN 3501.90, Contract D900054

Hazardous Waste/Contaminated Materials Additional Information for Contract 1 RFP

Watts Project Number 13092

Site ID #	Property Name and Address	Current or Former Use	Potential Environmental Concerns	Notes
3.2.5	CSX: DeWitt Railroad Yard	Railroad	Chemical/Solvent Contamination	Bridge will be renovated, recommend investigative soil borings near piers and abutment excavations (to depth of excavation). Contaminated soil assumed to be encountered.
3.2.6	Penske Truck Rental: 6755-6773 Manlius Center Rd	Automobile Related, USTs	Petroleum Contamination, Abandoned USTs	Edge of disturbance area, but tanks were likely near the building, and I-481 is elevated (for the bridge crossings) in comparison to this site.
3.2.7	84 Lumber: 6801 Manlius Center Rd	Lumber Yard and USTs	Chemical/Solvent Contamination, Petroleum Contamination, Abandoned USTs	Edge of disturbance area, but no ROW takes, there is a substantial drainage ditch between the property and roadway, and I-481 is quite elevated (for the bridge crossings) in comparison to this site.
3.2.8	Allied Spring & Services Inc: 6800 Manlius Center Rd	Automobile Related, USTs	Chemical/Solvent Contamination, Petroleum Contamination	No ROW takes and construction not adjacent.
3.2.9	B&C Self-Storage: 5991 Drott Dr	Automobile Related, USTs	Petroleum Contamination, Abandoned USTs	Construction is within ROW and not adjacent to this site. Contamination, if present, is likely off the ROW.
A	Residential Property 434 Garden Center Drive	Automobile Related	Petroleum Contamination, Abandoned USTs	Construction of noise barrier is on the embankment above grade from house. Contamination, if present, is likely off the ROW.
B	Mattydale Shopping Plaza 2803 Brewerton Rd	Automobile Related	Petroleum Contamination, Abandoned USTs	Construction of noise barrier on embankment above grade from and somewhat far from the shopping plaza. Contamination, if present, is likely off the ROW.

Notes:

1) Site ID #s 3.1.1 through 3.2.9 in the table above refer to the sites identified within the Hazardous Waste/Contaminated Materials Screening Assessment Report dated February 2020.

2) Site ID #s A and B in the table above refer to the sites identified within the Phase I Environmental Site Assessment for Proposed Noise Walls 16 A/B Memorandum dated May 17, 2021.

3) Bold in the table above highlights the CSX: Dewitt Railroad Yard where it is assumed that contaminated soil will be encountered.